Upscaling in-situ sensor data for EU-wide monitoring of agri-environmental conditions and production

Project info

Project Information

ScaleAgData
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Food, Bioeconomy Natural Resources, Agriculture and Environment

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€ 7 496 557,75

Coordinated by
VLAAMSE INSTELLING VOOR TECHNOLOGISCH ONDERZOEK N.V.
Belgium

Upscaling sensor data for EU-wide monitoring of agri-environmental conditions & crop production

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Sensor data

1st challenge: to make the data accessible

- Innovative data sharing infrastructure
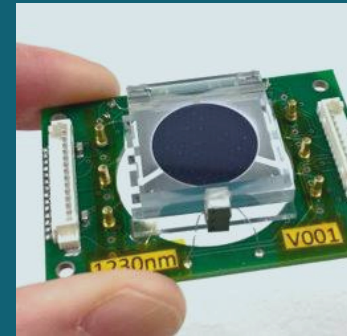- Data governance models

New sensors

e.g., hyperspectral camera based on FPI (Fabry-Pérot interferometry)

Innovative data processing technologies

- <u>Edge processing</u>, deployment of AI on the far edge
- <u>Privacy Enhancing Technologies</u>, PETs to access sensitive data

Development of improved data products

Better satellite data inputs using **satellite data augmentation** for
- cloud-filling
- improving spatial and temporal resolution
- improving the information content of the data using data reduction and feature selection techniques

CORSA algorithm architecture
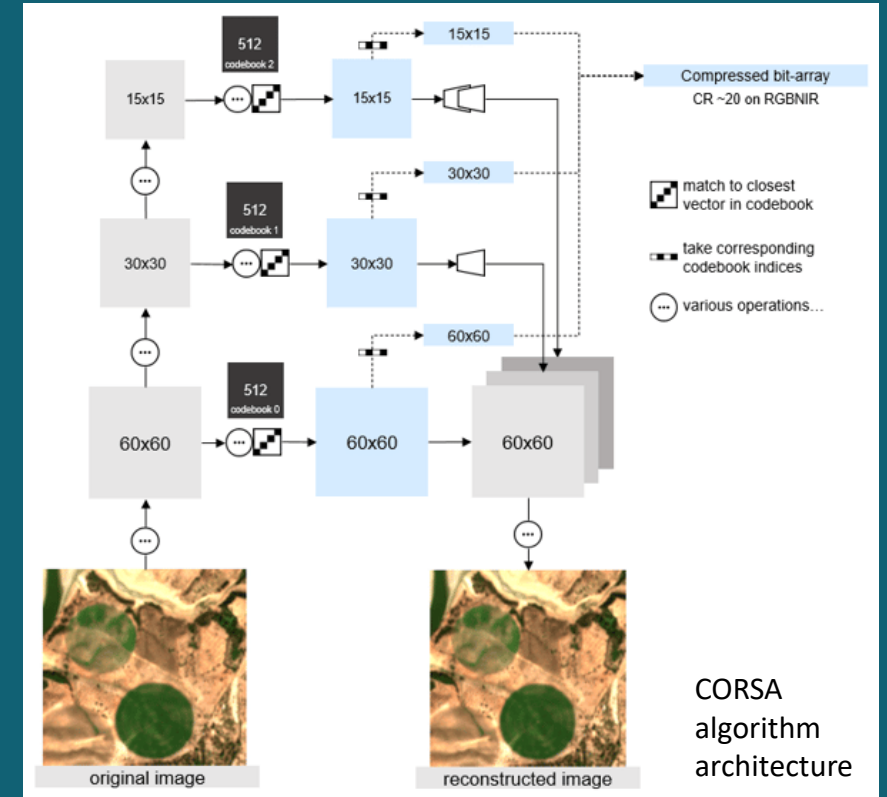
Development of improved data products by integrating sensor & satellite data

Better agri-environmental data products (soil moisture, ET, biomass production…) by testing & further developing **data integration methods**

- Deep learning: use of sensor data to
    - Improve local model/product accuracy
    - Improve the model itself.
      Continuous learning
    - To find the source of errors in a model
- To deal with (sensor) data scarcity:
    - *Transfer learning*
    - *Few shot learning*
   - *…*

Better services for farmers

From **data assimilation** to **service development**

- Traditional methods for assimilation of (improved) satellite data in crop simulation models such as APSIM
- *Simulation assisted ML*: models trained with synthetic data to forecast e.g., crop nutrient status or yield, in data-scarce scenarios

Part of "Prescriptive Digital twin" concept for decision making to support smart farming operations

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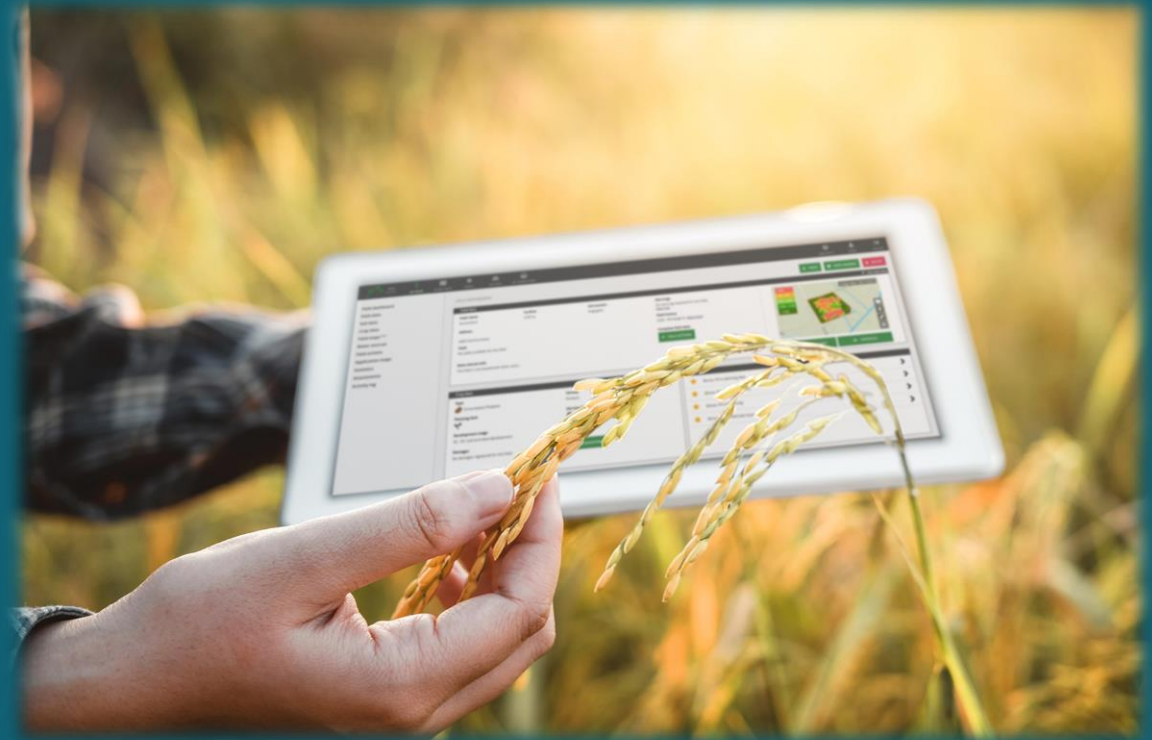
EU wide data products

Upscaling from sensor location → field → region → country
by integrating sensor and satellite data

To provide information
- for fields / farmers without sensors
- for all fields within a region

To provide regional or country statistics

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Serving a broad range of users
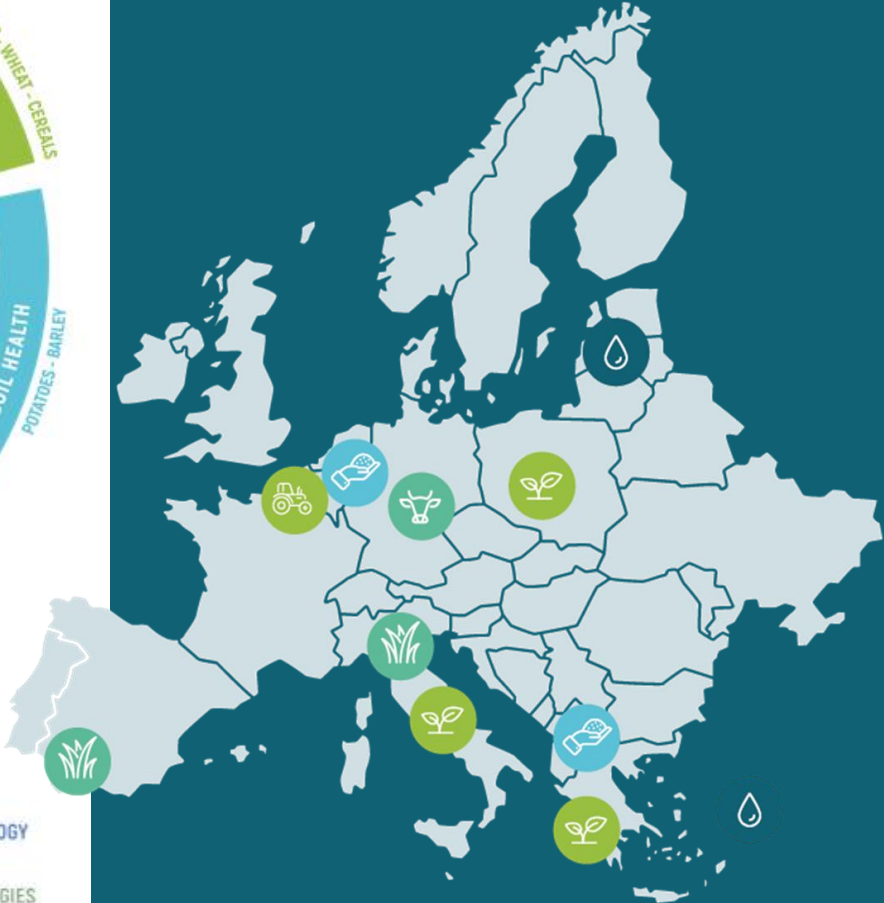
6 Research & Innovation Labs

- SENSOR & SERVICE INNOVATIONS
- DATA PRODUCTS & INTEGRATION INNOVATIONS
- INNOVATIVE USE OF DATA PRODUCTS

WHEAT - POTATOES
YIELD MONITORING

COTTON - POTATOES - TOMATOES - WHEAT - CEREALS
CROP MANAGEMENT

DAIRY

SOIL HEALTH
POTATOES - BARLEY

GRASSLANDS

WATER PRODUCTIVITY
PEPPERMINT - QUINOA

INNOVATIONS

1. INNOVATIVE SENSOR TECHNOLOGY
2. EDGE PROCESSING
3. DATA SHARING ARCHITECTURE & GOVERNANCE
4. SATELLITE DATA AUGMENTATION
5. PRIVACY PRESERVING TECHNOLOGY
6. DATA INTEGRATION METHODOLOGIES
7. FROM DATA ASSIMILATION TO SERVICE DEVELOPMENT

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Water productivity

Development & demonstration of service prototype for early detection of drought stress & recommendations for optimal irrigation regimes.

Target crops:
- peppermint
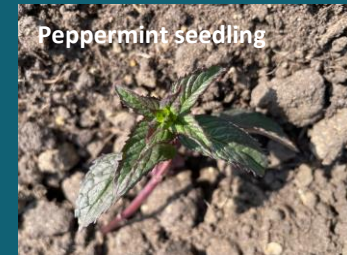- quinoa

Target areas:
- Latvia
- Israel

Sensor data:
- Weather sensors
- Soil moisture sensors
- Tensiometers

EO data:
- VNIR hyperspectral data (uCASI)
- Thermal data (uTABI)

Other data: sampled yield data

Peppermint seedling

IoT sensor for monitoring weather and soil

Institute for Environmental Solutions

MIGAL Galilee Research Institute LTD.

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Crop management

Unlock potential of sensor data for expanding smart farming services & monitoring sustainability to provide policy support, at European-wide level

Target crops:
- cotton, potatoes & tomatoes in Greece
- wheat in Northern Italy
- cereals in Poland

Sensor data:
- Weather sensors
- Pesticide sensor

Other data: cultivation practices, crop development stage, pest events, soil texture analysis

Target areas:
- Greece
- Northern Italy
- Poland

EO data:
- Sentinel-2 NDVI, EVI, LAI, NDWI

Yield monitoring

Unlock potential of yield data from harvesters, to estimate crop productivity at local & regional scale throughout the EU

Target crops:
- Wheat
- Potatoes

Sensor data:
- Yield from AVR & CNHi harvesters
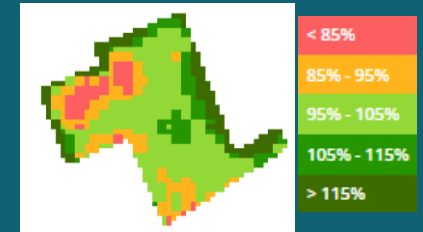- Weather sensors
- Soil scanners
- Crop scanners

Other data: crop cultivar, cultivation practices

Target areas:
- Precision farming: Belgium
- Upscaling: smaller area in Belgium, France, Germany (wheat), Europe (potatoes)

EO data:
- Sentinel-1, -2 biophysical parameters, phenology
- Sentinel-2, -3 evapotranspiration, soil moisture

< 85%
85% - 95%
95% - 105%
105% - 115%
> 115%

Soil health

Development of EO-based products on soil health & quality for decision support in management practices related to soil fertility

Target crops:
- Potatoes
- Barley

Target areas:
- Flanders
- Central Macedonia

Sensor data:
- Hyperspectral camera
- Soil scanner

EO data:
- Sentinel-2, -3 products

Other data: soil properties analysis data

Grassland monitoring

Improved grassland monitoring by combining ground info on biomass, biopars & carbon fluxes with EO technologies

Target crops:
- Mediterranean grasslands
- Alpine grasslands

Sensor data:
- Weather sensors
- Flux towers
- Soil probes

Other data: grassland fPAR, LAI and biomass measurements

Target areas:
- Mediterranean semi-arid oak savanna in Spain
- European Alps in Italy

EO data:
- Sentinel-2 reflectances
- Sentinel-1 backscatter

Alpine grassland

Instituto Andaluz de Investigación y Formación Agraria, Pesquera, Alimentaria y de la Producción Ecológica
Consejería de Agricultura, Pesca, Agua y Desarrollo Rural

eurac research

deimos

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Dairy production

Development of services for the dairy chain that facilitate agri-environmental monitoring & improve the overall efficiency of planning and control activities.

Target crops:
- Grassland

Sensor data:
- Grassland yield from harvesters

Other data: milk quantity & quality data

Target areas:
- Germany

EO data:
- Sentinel-2 products
- Hyperspectral products

Potential cooperation with ScaleAgData

During the project:
Feel free to contact us if you are interested in data sharing, product testing,... and become member of our external stakeholder network

After the end of the project:
- Data will be available
  - Sensor data:
    - Via data spaces
    - Directly via partners
    - Terms & conditions TBD
  - Improved EO products:
    - Commercially available via partners
- Methods will be available, e.g., through Jupyter notebooks

THANK YOU

More info on **www.scaleagdata.eu**
Contact us on **scaleagdata@vito.be**

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